

## **APPENDIX K**

### **PALEONTOLOGICAL RESOURCE MITIGATION AND MONITORING PLAN**



## **North Baja Pipeline, LLC**

# **NORTH BAJA PIPELINE EXPANSION PROJECT**

## **Appendix K Paleontological Resource Mitigation and Monitoring Plan**

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## **Appendix K**

### **Paleontological Resource Mitigation and Monitoring Plan**

#### **1.0 INTRODUCTION**

North Baja Pipeline, LLC (North Baja), will construct the North Baja Pipeline Expansion Project (Project), a new natural gas pipeline from the U.S.-Mexico border to the existing North Baja facilities and the El Paso Natural Gas system in Ehrenberg, Arizona. The Project includes three elements: the B-Line, which includes interconnection facilities in Ehrenberg, Arizona, as well as a 79.8-mile, 42- and 48-inch-diameter pipeline between Blythe and the Mexican border; the Arrowhead Extension, which includes a meter station and a 2.1-mile, 36-inch-diameter pipeline extending from the proposed B-Line at milepost (MP) 7.4 to Southern California Gas Company's existing Blythe Compressor Station; and the Imperial Irrigation District (IID) Lateral, a 45.7-mile, 16-inch-diameter pipeline between North Baja's mainline and the IID El Centro Generating Station. The Project will be constructed in phases, with the first phase planned for construction in 2007, the IID Lateral for 2008, and the final phase of the Project in 2009, pending completion of upstream liquefied natural gas (LNG) terminal facilities.

This Paleontological Resources Mitigation and Monitoring Plan (PRMM Plan or Plan) fulfills the requirements of the Federal Energy Regulatory Commission (FERC) and California Environmental Quality Act (CEQA) for an assessment of the potential impact on paleontological resources (fossils) of construction of the Project. A similar plan was prepared and implemented for construction of the A-Line in 2002. This Plan summarizes the findings of the assessment contained in Resource Report 6 and the mitigation and monitoring measures planned to mitigate the potential adverse impacts of Project construction on paleontological resources. The Plan includes avoidance strategies, mitigation measures including procedures for scientific removal of significant fossils, preparation/curation protocols, and provisions for a final report on the paleontological data recovery.

## **2.0 GUIDANCE MITIGATION CRITERIA: SOCIETY OF VERTEBRATE PALEONTOLOGY RECOMMENDATIONS**

Guidelines of the Society of Vertebrate Paleontology (SVP) are found in *Standard Measures for Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontological Resources* (SVP 1991, 1995, 1996), and have been adapted to evaluate the paleontological resources and potential adverse impacts of the Project, and to help formulate an appropriate mitigation plan to protect those resources considered scientifically important. The SVP standard measures address significance and sensitivity of paleontological resources and methods for mitigating adverse effects on fossil resources, including guidance pertaining to field assessment, monitoring, identification, storage, and compliance.

## **3.0 RESOURCE ASSESSMENT**

### **3.1 LITERATURE AND MUSEUM ARCHIVAL REVIEWS**

Prior to construction of the A-Line, paleontological literature and museum archival reviews for previously recorded fossil sites in the vicinity of the A-Line and a field reconnaissance were undertaken. All known geological and paleontological literature was reviewed for references to fossils. In addition, museum archival reviews were conducted at the University of California Museum of Paleontology (UCMP) at Berkeley, the San Diego Natural History Museum (SDNHM) at San Diego, and the San Bernardino County Museum (SBCM) in San Bernardino. The UCMP at Berkeley is considered the primary repository for fossils in the State of California and the UCMP collections are considered the most comprehensive of all California institutions.

Detailed information on the stratigraphy of the area was obtained from numerous geological publications. The geology in the vicinity of the proposed right-of-way has been mapped or described by numerous workers, including Brown (1923), Strand (1962), Jennings (1967), Metzger *et al.* (1973), Loeltz *et al.* (1975), Morton (1977), and Stone (1990). This report is heavily dependent on Dibblee (1954), Metzger *et al.* (1973), and Morton (1977), who have provided the most comprehensive and detailed accounts.

### **3.2 FIELD SURVEY**

The purpose of the field survey was to supplement the literature and museum archival reviews by verifying that sensitive rock units identified during these reviews occurred at the points previously mapped, to document the present condition of any previously recorded fossil sites, to look for any previously unrecorded fossils sites, and to identify areas where any special mitigation measures might need to be implemented prior to construction to avoid potential construction delays. Prior to construction of the A-Line, a field survey of the pipeline right-of-way was conducted during September 2000. Field monitoring took place in accordance with the PRMMP in effect for the A-Line construction in 2002. Paleontological discoveries along the A-Line in 2002 are listed in Table K-1. The IID Lateral route was field surveyed in November 2005.

**Table K-1: Paleontological Discoveries Along the A-Line in 2002**

<b>Milepost</b>	<b>Results of Paleontological Monitoring</b>	<b>Significant Paleontological Find</b>
25.7	Unidentified Holocene specimen (bone fragment)	No
27.2	Corals and calcareous algae in Bouse limestone	No
27.7-28.1	Turritelidae fossils, brachiopods, ostracods, foraminifera, amphistegina, echinoids, and algae	No
27.7-28.8	Slabs of chert hosting marine invertebrates	No
27.9	Large fossil log in Bouse Formation limestone spoil pile	No
28.1	Slabs of Bouse Formation limestone hosting kummel form echinoids	No
28.1-28.2	Echinoid (sea urchin) fossils of probably Miocene age (14 to 15 million years before present [mybp])	Yes
28.1-28.2	Small echinoid crowns, barnacles plates, and shark teeth	No
28.6	Chert/limestone pebbles; crinoids, corals, bryozoans, and sand shark teeth	No
28.5-29.0	Brachiopod in Bouse Formation	No
29.1	Paleozoic brachiopod	No
33.1	Petrified wood specimen	No
33.2	Paleozoic fossiliferous crinoidal limestone	No
32.1-35.0	Limestone nodule with Paleozoic fossil corals	No
41.5	Two petrified wood specimens in Pleistocene older alluvium	No
45.2-45.8	Marine fossils in carbonate pod (coral, bryozoa, crinoid ossicles)	No

### **3.3 ASSESSMENT OF POTENTIAL IMPACTS ON PALEONTOLOGICAL RESOURCES**

Construction of the Project could result in either adverse or beneficial impacts on significant paleontological resources. Adverse impacts may occur when Project earth-moving and ground disturbance result in significant fossils being destroyed. The destruction of significant paleontological resources could occur either directly by mechanical means or indirectly by allowing weathering agents to reach previously buried specimens. Mechanical destruction could result not only from actual trenching, but also from excavations during construction of access roads, clearing, and grading. Indirect adverse impacts could occur whenever weathering agents are allowed to reach specimens previously naturally protected by burial. For instance, indirect impacts could occur from any ground disturbance that causes fracturing of the ground, allowing the percolation of rain water through the disturbed sediment. Additionally, indirect impacts could result from any changes in surface grade that modifies the drainage pattern and allows erosion of previously protected areas; increased erosion could expose previously protected fossils to weathering and destruction.

Based on the literature and museum archival review, field survey, and A-Line construction monitoring, the paleontological sensitivity for stratigraphic units crossed by the proposed pipeline routes was determined. The potential for fossils based on paleontological sensitivity along the proposed pipeline route is summarized by milepost in Table K-2.

<b>Table K-2: Paleontological Sensitivity of Stratigraphic Units Found Along the North Baja Pipeline Expansion Project</b>		
<b>Mileposts</b>	<b>Stratigraphic Unit</b>	<b>Potential for Fossils</b>
<b>B-Line</b>		
0.0 – 11.5	Holocene alluvium	low sensitivity
11.5 – 22.3	Pleistocene older alluvium	moderate sensitivity
22.3 – 25.2	Holocene alluvium	low sensitivity
25.2 – 25.8	Pleistocene older alluvium	moderate sensitivity
25.8 – 26.0	Holocene alluvium	low sensitivity
26.0 – 26.6	Miocene fanglomerate	low sensitivity
26.6 – 27.0	Holocene alluvium	low sensitivity
27.0 – 27.3	Miocene fanglomerate	low sensitivity
27.3 – 27.6	Holocene alluvium	low sensitivity
27.6 – 28.2	Pliocene Bouse Formation	moderate sensitivity
28.2 – 28.5	Holocene alluvium	low sensitivity
28.5 – 29.2	Pliocene Bouse Formation	moderate sensitivity
29.2 – 29.9	Early Tertiary volcanic rocks	low sensitivity
29.9 – 30.2	Pliocene Bouse Formation	moderate sensitivity
30.2 – 31.2	Early Tertiary volcanic rocks	low sensitivity
31.2 – 31.6	Pliocene Bouse Formation	moderate sensitivity
31.6 – 32.6	Miocene fanglomerate	low sensitivity
32.6 – 32.8	Holocene alluvium	low sensitivity
32.8 – 35.8	Miocene fanglomerate	low sensitivity
35.8 – 36.3	Holocene alluvium	low sensitivity
36.3 – 75.2	Pleistocene older alluvium	moderate sensitivity
75.2 – 79.8	Holocene alluvium	low sensitivity
<b>Arrowhead Extension</b>		
0.0 – 2.1	Holocene alluvium	low sensitivity
<b>IID Lateral</b>		
0.0 – 2.0	Pleistocene alluvium	low sensitivity
2.0 – 7.6	Dune sands	low sensitivity
7.6 – 27.6	Quaternary alluvium	low sensitivity
27.6 – 45.7	Quaternary Lacustrine sands	Low-moderate sensitivity



The results of literature and field review, and monitoring during the construction of the A-Line revealed very limited paleontological resources. Of the several areas identified during pre-construction analysis as moderate sensitivity along the A-Line, only a short stretch of about a mile, from MP 28.1 to MP 29.1, yielded a single significant paleontological find. Areas of Pleistocene older alluvium, potentially of moderate sensitivity and identified from MP 11.5 to MP 22.3, yielded no paleontological materials. Other areas of Pleistocene older alluvium, including MPs 35-75.2, yielded only occasional paleontological materials and no significant finds. The Arrowhead Extension is located in the same Holocene alluvium stratigraphic unit as the first 11.5 miles of the B-Line. The four stratigraphic units crossed by the IID Lateral have a low to low-moderate potential to yield paleontological resources, and the construction of the IID Lateral is unlikely to affect such resources.

Implementation of a paleontological resource mitigation plan prepared by a knowledgeable and experienced paleontologist can result in a substantial reduction in the severity of adverse construction-related impacts, both direct and indirect. A well-designed and fully implemented mitigation program can even provide some beneficial impacts by uncovering and recording information about or preserving significant fossils and associated geologic and geographic data in a public museum where they are available for future study by qualified investigators.

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## 4.0 MITIGATION AND MONITORING

The purpose of the PRMMP is to assist North Baja in complying with environmental laws and permit requirements regarding the protection of significant paleontological resources that might be encountered during Project construction. The goal of the proposed program is to minimize the potential negative effects of Project construction to a point where no significant effect on paleontological resources will occur.

### 4.1 PROJECT-WIDE MEASURES

Construction of the Project will involve several known fossil-bearing rock units. However, the paleontological sensitivity of stratigraphic units crossed is low overall, taking into account literature, field review, and monitoring during the construction of the A-Line. Due to the widespread geographic distribution of these geological formations, a paleontological resource mitigation program has been developed. This mitigation program includes construction-worker education and spot monitoring of selected sections of the pipeline right-of-way during excavation to salvage any significant fossil remains encountered during construction involving ground-disturbing and earth-moving activities.

More specifically, the paleontological resource mitigation program includes the following:

#### **Avoidance Strategy**

1. All construction personnel will be given environmental training that will include instruction in both verbal and written form regarding what fossil resources may be encountered during construction. The Environmental Inspectors will receive additional instruction in fossil identification from the Project Paleontologist.
2. Construction personnel will be instructed that, if fossils are seen in areas without a Paleontological Monitor, the Environmental Inspector and the Project Paleontologist will immediately be notified, and the fossils will be avoided by further construction activities until a determination of the significance of the discovery can be made and a plan of action can be formulated.
3. Construction personnel will also be instructed that excavation spoils surrounded by exclusion fencing or survey flagging are to be avoided under all circumstances, and that any intrusions into an exclusion zone by personnel or equipment other than under the direction of the Project Paleontologist are strictly prohibited.
4. If the Paleontological Monitor or Environmental Inspector note an unusually large number of fossils or an individual highly significant specimen being excavated or disturbed by earth-moving operations, he or she will immediately contact the Project Paleontologist. The Environmental Inspector may temporarily halt construction activities until consultation with the Project Paleontologist and (on Federal lands) BLM staff to determine whether site-specific mitigation requirements are warranted.

5. Depending on the specific circumstances, the mitigation procedure could either: move construction away from the fossil locality and return later to carefully excavate the fossil site under the direction of the Project Paleontologist; or excavate through the fossil site, destroying a portion of the site, and salvaging a representative collection of significant fossils from an adjoining portion of the site.

### **Other General Mitigation Measures**

1. A Paleontologist Monitor or Environmental Inspector will spot monitor ground-disturbing activities along those sections of the pipeline right-of-way identified during the literature/archival reviews and field survey as having a moderate potential for paleontological resources (see Section 4.2). During excavation in stratigraphic units with fossil-bearing potential, the Paleontologist Monitor or Environmental Inspector will monitor trenching activities and examine freshly exposed surfaces during clearing and grading operations. The Paleontologist Monitor or Environmental Inspector will salvage significant fossils exposed during construction after consultation with the Project Paleontologist.
2. Each significant salvaged fossil will be preliminarily identified to the lowest taxon possible by the Project Paleontologist before curation into the retrievable storage system. Specimens preserved in rock matrix will be prepared only sufficiently to provide a taxonomic identification.
3. During Project construction, the Paleontological Monitor or Environmental Inspector will prepare reports that will be summarized by the Project Paleontologist into a brief quarterly report to be submitted to the FERC, CSLC, and BLM. In these quarterly status reports, the Project Paleontologist will briefly describe the results of the paleontological resource mitigation program during that quarter.
4. During construction, if no fossil remains have been discovered after one-half of the excavations through any individual stratigraphic unit have been completed, upon the recommendation of the Project Paleontologist monitoring in that stratigraphic unit may be reduced or suspended entirely.
5. At the end of the Project, the Project Paleontologist will prepare a final report of findings that lists and places in a scientific perspective all significant salvaged materials.

Implementation of the mitigation measures described above will ensure protection of significant paleontological resources and result in compliance with Federal and State environmental guidelines.

## **4.2 SITE-SPECIFIC MITIGATION MEASURES**

### ***4.2.1 B-Line***

Results of the paleontological monitoring conducted during the construction of the A-Line in 2002 are summarized in Table K-1. Based on the archival research and monitoring undertaken during the construction of the A-Line, monitoring of B-Line construction by a paleontologist is planned only through MPs 27 to 29, where the outer edge of the Bouse Formation is crossed.

### ***4.2.2 IID Lateral***

Based on low sensitivity of the stratigraphic units crossed by the IID Lateral, spot monitoring is planned. Between MP 27.6 to MP 46, spot monitoring recommended unless excavation unearths coarse beach intervals or thicker sand/gravel lenses. In the latter event, probability for fossils rises to high in those intervals and continuous monitoring is recommended.

## **5.0 FOSSIL EXTRACTION**

The overall probability of discovery of salvageable fossils is at best only moderate in even the most promising intervals of this proposed right-of-way. If salvageable fossils are encountered, they would most likely be individual separate (disarticulated) bones of larger mammals such as elephants or other hoofed taxa like horses or bison. Predators, because of their inherent low frequency in any environment, are very unlikely.

Owing to the virtually unconsolidated nature of nearly all intervals of the multiple stratigraphic units along the right-of-way, the extraction of any fossil remains here would be a relatively simple and rapid process. Extraction and removal of individual post cranial skeletal bone elements might even be effected without having to resort to the use of plaster field jackets. Skulls, particularly those of larger ungulates, would probably require plaster jackets but the tedium and time-consuming process of exposing, undercutting, and removal of the fossils is greatly eased by the unconsolidated nature of the sediments.

## **6.0 CURATION AND REPORTING**

### **6.1 PROTOCOL FOR CURATION/REPOSITORY STORAGE OF FOSSILS**

Fossils encountered and judged salvageable by the Project Paleontologist along the Project route will be removed, stabilized, and accessed into museum collections. Museums in the vicinity of the right-of-way, including the University of California's Museum of Paleontology at Berkeley, Los Angeles County Museum, Anza Borrego Museum, San Diego Museum of Natural History and the San Bernardino County Museum all maintain collections of fossils that would be similar to those likely to be found on the Project. Contacts with museum personnel from these establishments suggest they would be willing to examine a suite of fossils salvaged and select any materials they wished to access into their collections.

Field collection is to follow standard strategies including, where necessary for vertebrate materials, plaster jackets. Materials are to be cleaned and stabilized only to the degree necessary for removal from the field and transport. Curation, including identification to generic or where possible specific levels, will proceed when materials arrive at the laboratory. Facilities for fossil preparation/curation are available at the Condon Museum, which is the Oregon State Museum of Paleontology, and that laboratory will be utilized for the initial stabilization and preparation of fossils.

At all these facilities the fossils will be available for study, teaching, research, or display to the scientific community as well as the public at large. Disposition of all fossils, including repository specimen numbers, will be part of the final report.

### **6.2 FINAL REPORT**

Upon completion of the work, the Project Paleontologist will prepare a final paleontology report. The report will include a complete faunal and floral list of all taxa recovered and salvaged as well as museum collection accession numbers on all fossil objects and their final disposition (storage). The report will also include a summary narrative on the scientific import, which will address both the entire collection as well as specific specimens, depending on their significance.

This report will include, as prescribed by the SVP (1991, 1995, and 1996), a summary of the stratigraphy and lithology of fossil-bearing strata, taxonomic lists of plant and animal specimens noted and salvaged along the right-of-way and their scientific significance, and complete detailed records of the localities when collection took place (SVP 1991, 1995, 1996). In addition, the ultimate repository in California for each salvaged fossil along with the museum accession number will be recorded in addition to its identification to the lowest taxonomic level (genus and/or species) following stabilization and preparation to a sufficient degree that such identification might be made. A complete bibliography of pertinent papers on the taxa identified

will be part of this report. The final report will be distributed to the FERC, CSLC, BLM, BOR, Cibola National Wildlife Refuge (NWR), and other interested parties.

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